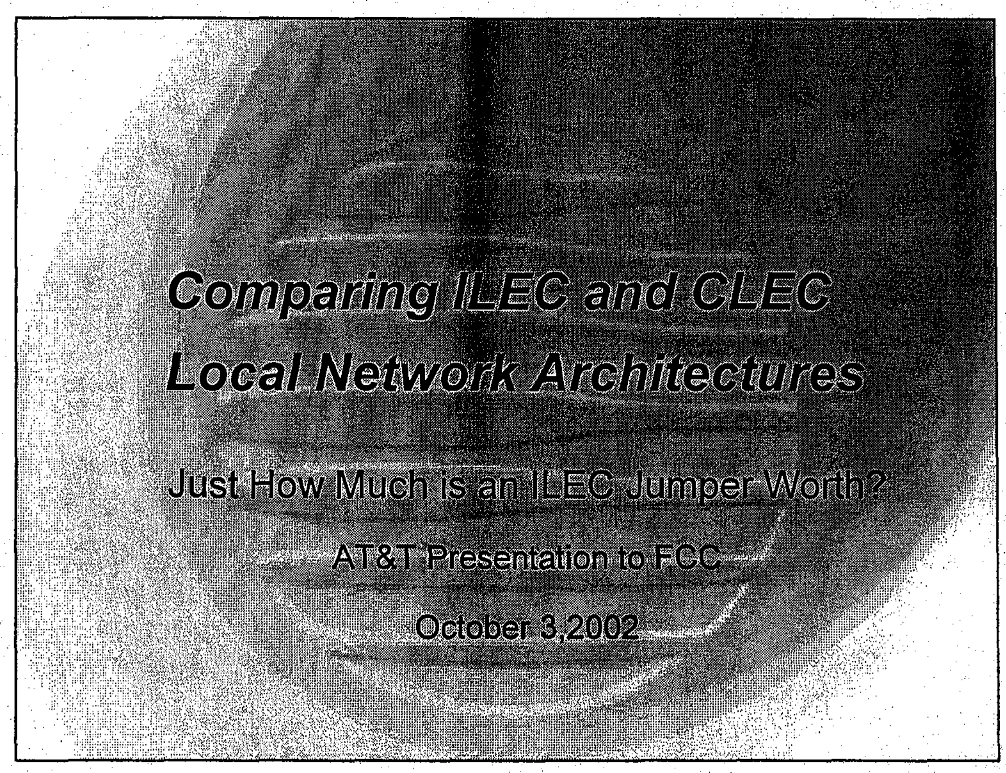


The purpose of this presentation is to:

-Describe the ILECs' network architecture and demonstrate the ILECs' ability to

(1) balance loop and switching costs;

(2) minimize the need for additional construction to serve "green field" locations and additional demand from existing customers; and

(3) employ tandem switching to implement a layered network architecture

-Describe the CLECs' network architecture and the different realities that CLECs must face in order to serve DS0 loops with their own switches because they must extend their customers' loops beyond the ILEC LSO and incur significant additional costs, including:

(1)collocation

(2)transmission equipment

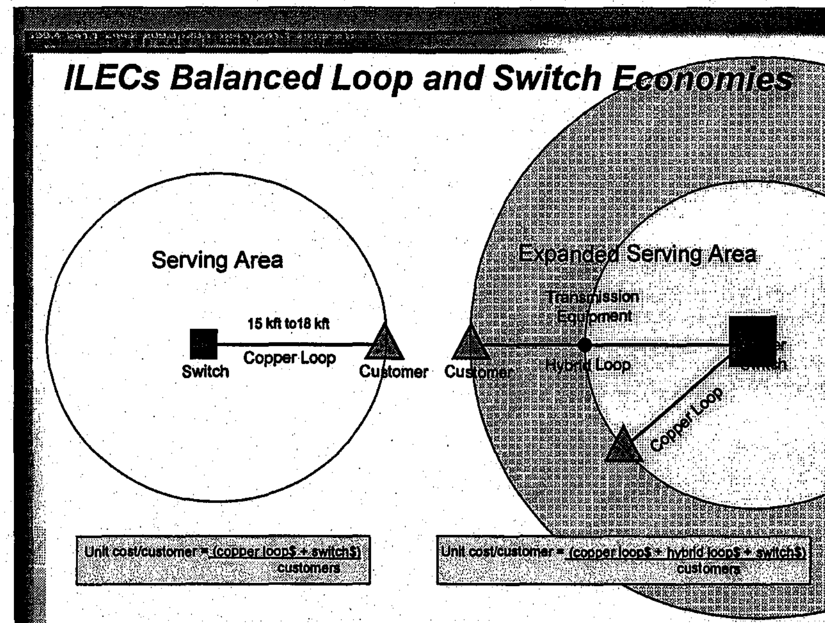
(3)transport

(4)loop re-termination costs,

all for the sole purpose of replicating the functionality of a cross-connect across the ILEC main distribution frame

-Explain the cost drivers for CLEC loop extensions and demonstrate how these costs make it (1) difficult to develop a rational economic case to support CLEC switch-based service for DS0 loops even at facilities-based ("on-net") hub collocations and (2) virtually impossible for DS0 loops not on an existing CLEC ring, especially if hubbing is discouraged by regulatory rules

-Demonstrate the importance of hubbing to CLEC economics in serving DS0-based loops and the negative implications for creation of additional hubs resulting from the current use and commingling restrictions



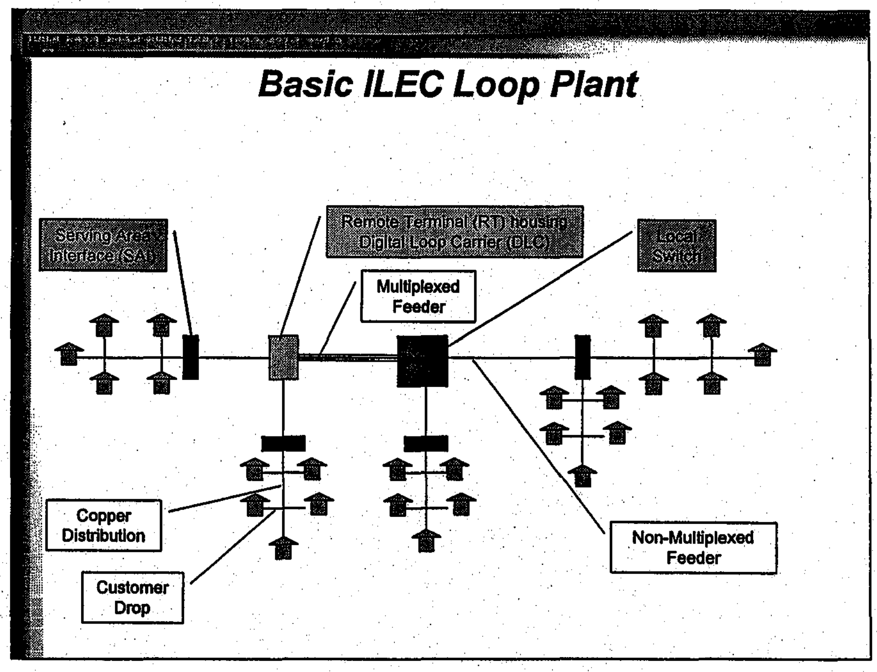
The ILECs' local networks were designed for market entirely different from that governing the design of the CLECs' local networks. The ILEC's local networks reflects its monopoly heritage and its ability to deploy loop plant and switches to serve all customers in a geographic area, thereby allowing optimization of combined loop plant and switched network costs.

Loops are basically low capacity transmission facilities. In most cases, and particularly for residential customers, the facility supports relatively low communications density (typically only 64 kbps and rarely anything more than 1.5 Mbps) Such communications are cost-effectively delivered over copper facilities. Copper facilities, however, cannot generally support voice communications if the electrical length of the facility exceeds 15 to 18 kilofeet. Beyond that length, additional transmission equipment is required to address signal degeneration. A typical loop facility supports a few hundred to a few thousand customers and has substantial fixed costs.

Like loops, switches have relatively high fixed cost to deploy but are designed to serve tens of thousands of customers. Because of the fixed costs it is critical that switches be used to the highest practical utilization so as to attain the lowest possible cost per subscriber. However, as indicated by the checker-shaded area, the customers served only by copper loops might not efficiently fill the capacity of a switch.

ILEC engineers addressed this issue by investing in added transmission equipment and thereby serving more customers with a single but larger switch. By placing such additional equipment at a point intermediate to the customer and the switch, the switch service area could be expanded to allow it to serve more customers. This is indicated by the dark-shaded area. Investment in added transmission equipment was rational as long as the added cost of the transmission equipment and marginally larger switch produced a lower average total unit cost per customer served.

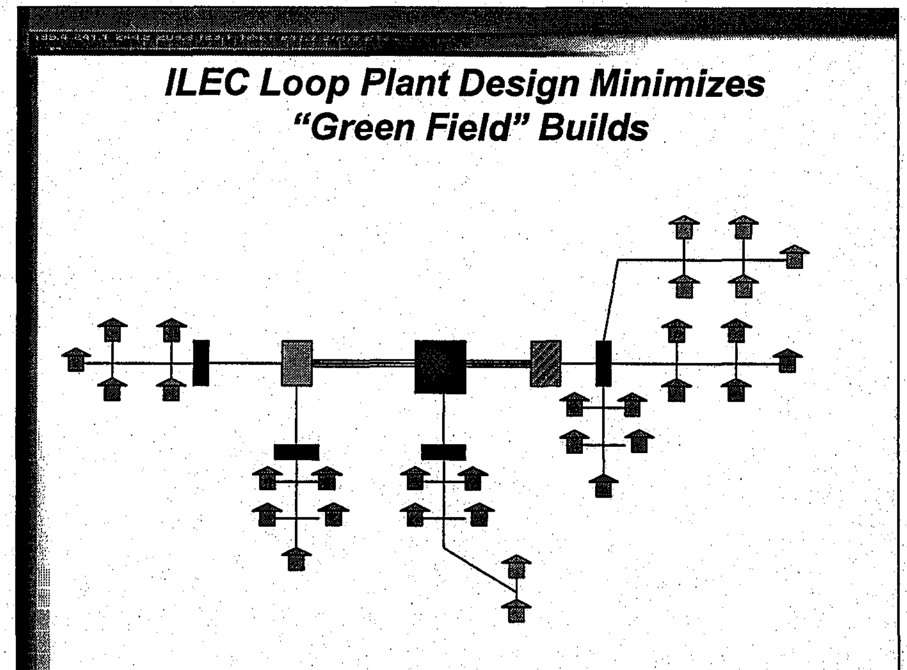
Today about 65-70% of working channels are served by copper loops (ARMIS 43-07) and the mean loop length is about 12 kft (Telcordia Notes on the Network, Distribution, SR-2275, Issue 4 October 2000, p.12-9)



ILEC loop plant was and is designed to be both flexible and yield significant economies of scale. Because of the high costs of adding new outside plant infrastructure (conduit, ducts, poles, and etc.), the design sought to minimize the probability of costly construction after the initial facility deployment occurs.

Flexibility is achieved by intentionally including cross-connect points in the outside plant facilities, so that defective segments of a transmission path can be replaced by a working segment without having to replace the entire loop. The remote cross-connection point is typically at the Serving Area Interface (or SAI) where both the facility connecting to the customer premises (i.e., the distribution facility) and the facility connecting to the local switch (i.e., the feeder facility) terminate.

Scale was gained primarily because the incumbent had an exclusive franchise. Because the incumbent served all customers in an area, it could home customer premises connections (called distribution facilities) to central points where larger "feeder" cables (and possibly transmission equipment) could be used for the connection to the central office. To the extent transmission equipment was inserted, it typically was some form of Digital Loop Carrier (or DLC) housed in a Remote Terminal (or RT) which may alternatively be called a Controlled Environment Vault (CEV) or hut. The DLC digitizes the analog signal from the distribution facility and multiplexes it onto a shared feeder facility connected to the serving local switch. In more modern DLC (e.g., GR303), the DLC is also capable of performing concentration. Concentration allows more customers to connect to the RT than could be served by the shared feeder in situations where an unusually high proportion of customers seek to make or receive calls at the same instant. Both multiplexing and concentration improve loop scale economies by enabling the incumbent to share the feeder infrastructure among more retail customers



The ILEC loop design was established in a manner that accommodated service to new localities as well as additional service to existing customers. All this was done to minimize the likelihood that the incumbent would have to engage in new construction to parallel existing facilities. The costs of laying a facility are both substantial and generally insensitive to capacity. Thus, although more costly up front, it is a prudent investment to (1) deploy excess capacity and (2) design the plant so as to permit subsequent insertion of pair gain (i.e., DLC) technologies. The incumbents did both. As a result, the incumbent's existing loop plant is readily expanded to accommodate either "new" locations and/or greater service demand from existing locations at a low incremental cost.

For example, if added services are required into a home, the drop generally has spare pairs that can be utilized. If a relatively small numbers of new locations are added, the ILEC can often splice into (or bridge tap) existing but unused distribution facilities. If a new housing development or business park requires service (or existing locations require significantly more lines), increased capacity may be obtained (1) by inserting DLC where none previously existed, (2) by adding capacity to the DLC, (3) by add a new distribution cable or (4) by any combination of the preceding. If the feeder capacity only requires minor upgrade, distribution pairs can be multiplexed onto a significantly smaller number of copper feeder pairs. In the alternative, "dark fiber" that may have been deployed in conjunction with other projects (e.g., interoffice facilities) can be employed or new fiber may be deployed. However, when new fiber is deployed, it typically need only be constructed between the serving location and the existing fiber feeder plant in the incumbent's already-built loop plant.

Because the ILEC served a specific territory and all the customers in it, the ILEC could usually anticipate where new growth might occur, and because it had relatively certain access to capital and relatively assured returns, its loop plant facilities could be deployed with reasonable amounts of excess capacity and with access points that permitted incremental expansion, rather than "green field" construction or reliance on a "build it and they will come" strategy.

ILEC Inter-Switch Network

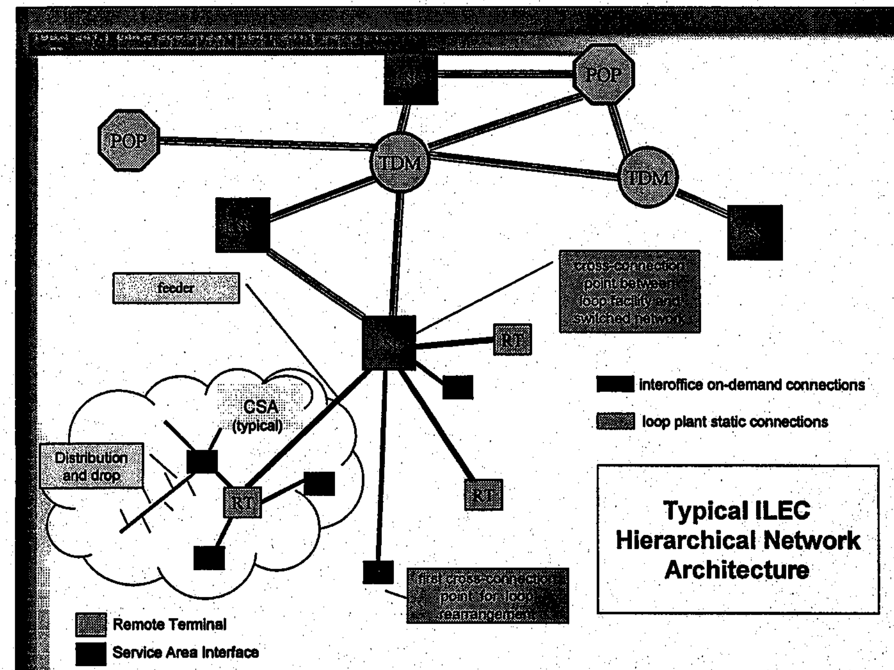
- ILEC local switches served virtually all customers in a limited geographic
- Compact service areas result in deployment of numerous switches but direct connections between each pair of switches is impractical
- The ILEC toll network was effectively a separate but interconnected network
- Tandem switches yield large and efficient inter-switch transmission facilities
- The ILEC switched network is layered

Because ILEC loop plant was largely copper (and length limited), its switches served relatively compact geographic areas, and numerous switches were deployed within close proximity to each other. In fact there are now about 15,000 local switches operated by the largest ILECs. The number deployed in any particular state runs from as few as 29 switches in WY to as many as 1276 in CA. In fact, CA is one of the states with the lowest penetration of DLC . As a result, one would expect to see a higher number of switches because of the relatively shorter loops, even discounting for the large population

Furthermore, local calling areas of the incumbent – generally the geography served by a few contiguous switches – account for the largest proportion of the total calling load. In round figures, about 75% of the calling is local in nature (see Table 8.5 p. 8-7 October 2001 Monitoring Report of the FCC) with about 50% being intraswitch (see Engineering and Operations in the Bell System, 1983, The Bell Telephone Laboratories, Table 4-5, p.125). Thus, the majority of calling is local: intraswitch calling accounts for about half of all calls, and another 25% is local inter-switch traffic. The remaining calling (25%) is destined to widely scattered offices in the state or across the country.

In order to economize on the use of interoffice transmission facilities, which would otherwise tend to have very low utilization, the ILECs deployed tandem switches. Tandem switches do not connect directly to end users but connect other switches and consolidate calling from and to subtending switches that are serving end users. In other words, because too little calling existed between points A and B to justify a direct transmission facility, the traffic is directed to a tandem (or intermediate) point C. Other switches could do the same with their traffic to end point B. The tandem switch at C allows sharing of a single larger capacity facility to B, although no individual office could justify a direct facility of its own.

Accordingly, the ILEC network has two layers of switching. The total cost of the added tandem switching, however, is more than offset by the avoided costs of constructing many low volume inter-switch trunk facilities.



All the preceding discussions are summarized in the above diagram. It simply shows what has long been understood – that transmission facilities and switches are expensive and each represent high fixed costs. Accordingly, the two assets must be deployed *in concert* so as to optimize the use of both. The green portion is the incumbent LEC loop plant. It generally consists of transmission facilities that provide a transmission path, dedicated to the customer premises, that connects the particular premises to one and only one local switch. While limited sharing of transmission capacity may occur as the facility gets closer to the first point of switching, the path between the customer and the first point of switching is the same for all calls. Thus, this the portion of the network is a static connection.

On the other hand, the blue portion of the local network is the interoffice connectivity. This is the portion of the network where substantial demand aggregation occurs. Note, however, that the number of points that must be interconnected has expanded by orders of magnitude. The interoffice network is characterized by very high capacity transmission facilities where the capacity is interconnected, on-demand, to create the desired end-to-end connection.

By making appropriate choices of when and where to deploy copper loops, DLC enhanced loops, local switches, interoffice facilities and tandem switches, an incumbent can (1) maximize its efficiencies in the use of each, (2) minimize its average cost per customer, and (3) build in access points and additional capacity to serve both new and expanded demand for service at a low incremental cost.

CLEC Local Networks

- Customer base is widely distributed across thousands of ILEC LSOs
- Few individual customer locations require more than a few Voice Grade Equivalents (VGEs) of loop capacity
- ILEC loops connect only to ILEC networks
- UNEs, EELs and special access are all "purchased" solely to obtain the equivalent of local loop connectivity
- Efficient demand aggregation is critical to controlling unit costs
  - — Customer to LSO
  - — LSO to hubs
  - — Hubs to CLEC network
- Long "loop" facilities required to reach CLEC customers result in fewer local switches and a flat, rather than layered local network

CLEC network design is subject to the same engineering objectives as is the incumbent LECs' network design, i.e.. to balance costs of transmission and switching investments through prudent demand aggregation. However, the primary difference between the ILECs' and CLECs' approach to network design is that the CLEC must work within the limitations of the ILECs' already deployed loop plant. CLECs cannot generally replicate the "last mile" facility of the incumbent and, in order to use the incumbent's loop facility, the CLEC must extend connectivity substantial distances in order to connect customers to their switches.

This has two immediate implications: First, many different UNEs must be employed to create what is effectively a loop for the CLEC. Second, CLEC networks are flat rather than layered.

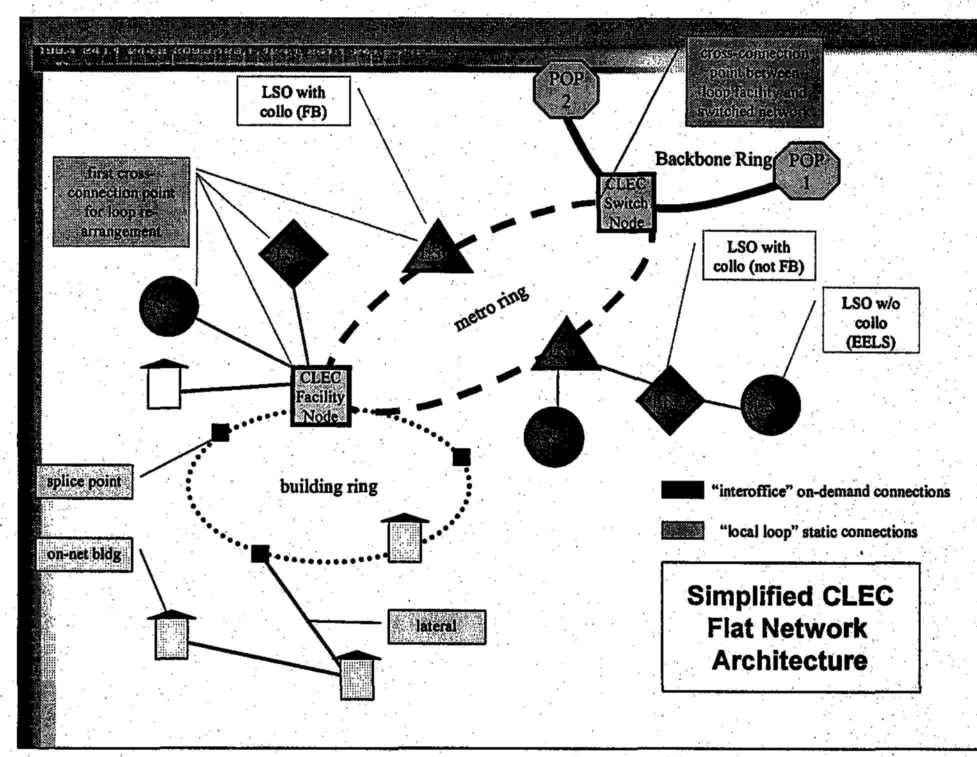
Unlike ILECs, CLECs enter markets without a large pre-existing base of customers. Although CLECs can target particular customers, mass marketing is difficult to align with ILEC LSO boundaries and locations where the CLEC may have collocation readily available. Thus, creating a critical mass of demand in a particular LSO is difficult.

It is even more difficult to build such critical mass if the CLEC is restricted to only addressing customers whose loops terminate within a particular LSO. The vast majority of customer loops are served using copper or hybrid technology partially based in copper In fact the ARMIS reports (43-07) shows the RBOCs had about 120M copper loops in service in 2001 (row 381). Such "all copper" loops typically support bandwidth at or under 1.5Mbps. The consensus view is that there are only about 50,000 buildings in the entire country that generate demand sufficient to warrant use of a fiber-based loop.

Although copper-based loops are efficient for serving the vast majority of customers (including those who require bandwidth exceeding 1.5Mbps), no individual competitor today could ever hope to efficiently deploy a copper-based local loop network. On the other hand, there are so few locations requiring the infrastructure associated with fiber loops that such facilities will not be widely deployed by CLECs either. Thus, CLECs not only must face the fact that it is generally uneconomic to build their own loops but they also must face the fact that the loops they must access terminate only in ILEC LSOs. This means the CLECs must, by various means, extend the ILEC loop facility to their own switch. To do so, the CLECs must employ critical intermediate demand aggregation techniques to better assure their unit costs do not become prohibitive

Taken at face value, the ILEC Fact Report 2002 shows (Table 1, III-2) asserts that fiber-based carriers are located in 13% of RBOC wire centers. This equates to 1,100 to 1,200 locations where about 2,400 points of access to various CLEC networks occur, assuming that all are operational. The most recent FCC Local Competition Report (7/02) shows that there are 7.5M facility-based lines (6.1M owned or SA – 2.2M cable + 3.7 UNE-L). Thus, on average, about 3,100 VGEs pass through each CLEC access point, assuming that all the CLECs are still in business and actually providing local services through those points. Of course, given the recent spate of CLEC bankruptcies this is not likely, so this estimate, which equates to the equivalent of 5 DS-3s, must considered a low estimate of what is a practical minimum threshold for facility-based collocation by a CLEC.

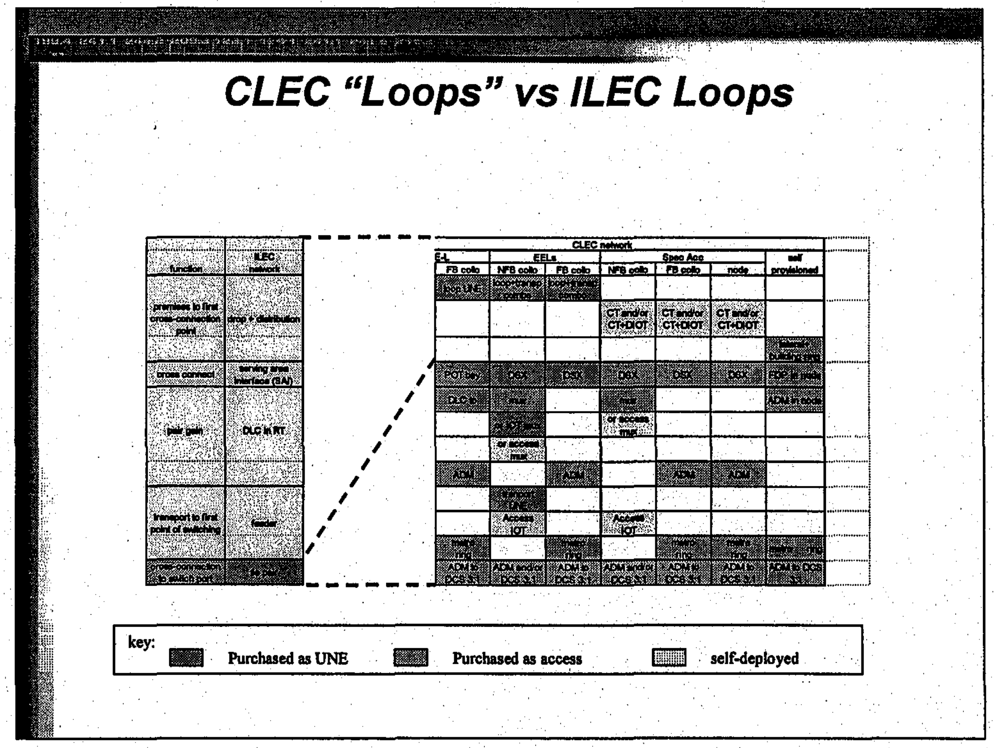
The question that naturally arises is: How, if ever, will customers in the remaining 87% of wire centers be addressed by a facility-based CLEC? The answer is simple: Facility-based competition will be extended to such customers only if there is continued and unrestricted access to unbundled elements, primarily all forms of loops and transport.



From a conceptual standpoint, a CLEC's network looks very different from an ILEC's. The CLEC's network employs facility rings with limited points of "interlock." On the other hand, the ILEC loop plant has the physical characteristics of a tree -- the switch at the base of the trunk and the branch tips being the individual customer locations.

The two configurations are not that different on a logical basis, or the manner in which communications channels are established within the physical facilities. In both instances, a continuous connection will be traceable from the first point of switching all the way to the customer premise. The real difference is that the CLEC facility ring, through the use of "intelligent" transmission equipment, provides virtually instantaneous restoration of the facility. That is, if one portion of the ring facility is damaged, the path in the opposite direction of the ring is used. Such protection does not exist, however, on the laterals and loop extensions from facility-based collocations in ILEC LSOs.

The green portion of the diagram represents non-switched facilities connecting the customer's premises to one and only one CLEC switch. As such, it provides the identical functionality to the green portion of the ILEC network slide. The main difference is the the green portion of the ILEC diagram terminates at the locations labeled "LSO" in the diagram of the CLEC network. In sharp contrast, the CLEC loop *cannot* end at the LSO but must be extended to the CLEC switch located elsewhere. Thus, all of the green portion of the CLEC diagram on the network side of the LSO (including collocation and all related equipment) is necessary to provide the equivalent functionality of a simple tie pair between one side of the ILEC main frame to the other. All of it is needed to connect the traditional loop to the CLEC's local switch.



This chart shows the primary components of traditional loop plant and compares the ILEC configuration to the CLEC configuration.

The various colors show alternative ways that the components for the main classes of functionality might be "purchased" by a CLEC.

Note, in particular, that virtually all cases (the only exception being the case of self-provisioned loops) the CLEC uses all the ILECs' loop plant (paying for the use under a variety of regulatory schemes) in order to bring the loop to the first point of practical cross-connection -- the LSO where collocation exists. In sharp contrast to the cost of an ILEC tie pair (which cross-connects the ILEC loop to the ILEC switch port), the CLEC must incur very substantial collocation, transmission equipment and transport costs to provide the functional equivalent to the ILEC's tie pair at the MDF (or DSX for other than voice grade services). All this added cost, whether obtained as a UNE, special access or through self-provisioning (or combinations thereof) result from the fact that CLECs cannot place their switches where the ILEC loop plant terminates.

Glossary of abbreviations

CT – Channel Term (access equivalent of a loop)

DIOT – Dedicated interoffice transport

POT Bay – Point of Termination Bay (DS0 cross-connect device)

DLC – Digital Loop Carrier

IOT – Interoffice Transport

Mux – Multiplexer, generally from DS1 – DS3

ADM – Add/Drop Multiplexer, generally to/from OC-3/DS3 to OC48

FDP – Fiber Distribution Panel

DCS 3:1 – Combined DS3-DS1 multiplexer and cross-connection device

CLEC Inter Office Network

The "flat" CLEC network design is an outgrowth of the manner in which customers are accessed and the evolution of transport technology

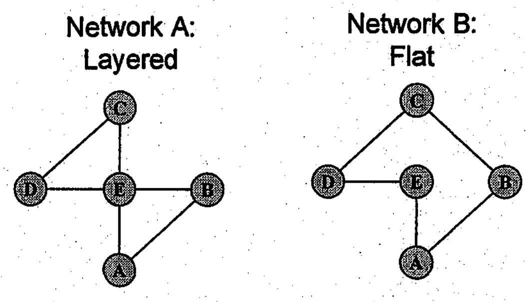
- Customer locations tend to be widely dispersed – CLEC switches can only be efficiently loaded by aggregating demand from a wide geographic area
- Use of fewer and larger switches, combined with ring transport, is virtually the only way to offset CLECs' need for more extensive "loop" plant
- Very high capacity inter-switch ring transport facilities costs are largely demand insensitive, making direct connection of all switches on a ring more efficient that using tandem switching
- Except as a short term expedient, CLEC are not likely to complete inter-switch rings using UNEs or special access

The essentially flat CLEC network architecture is a natural outgrowth of the conditions governing its design. Because loops accessed in many ILEC LSOs are brought to a centrally located switch, CLEC switches serve large geographic areas and customer calling within those areas is intra-switch calling. As a result, once a collocation and associated transmission equipment are deployed, the CLEC's engineering/economic trade-off is largely between the incremental cost of a longer facility and the marginally lower unit cost of a larger switch.

Given that there are relatively few IXC POPs in a state and because there are relatively small numbers of CLEC switches, it is feasible to connect these points directly. For example, if there are 3 CLEC switches in a state and and two IXC POPs, 20 unidirectional connections are required to connect all points. On the other hand, as the number of switches (n) increases, the number of required connections increases at a geometric rate (n*(n-1)). For example, in a city like Washington DC, where the ILEC has 30 switches, 870 connections would be required to provide direct connections between each.

As discussed earlier, tandem switching serves to reduce the costs of transport facilities. However, the costs characteristics of fiber transport change the trade-off somewhat. Fiber transport has very high fixed costs per mile and additional fixed costs per end. However, costs of added capacity, or extra strands in the same cable are minimal. Thus, when few points are to be connected (as in the CLEC network), it may be cost effective to find the minimum mileage path that sequentially links one node to the next, and then to place at least as many strands as there are nodes. Ideally, the CLEC should deploy as many strands as it can practically afford. This approach is precisely what most CLECs employ and it produces a flat network with high reliability.

Ring Transport is Efficient for CLECs



from	to	distance
A	B	14
B	C	14
C	D	14
D	A	14
E	A	10
E	B	10
E	C	10
E	D	10

	LAYERED	FLAT
Segments	6	5
Conductor Miles	68	62
Number of Routes	8	8
Route Miles	136	310
Point of Failure	1 (at E)	0

This diagram illustrates the difference between a flat and layered network. Network A is layered and employs a tandem switch at point E. Because points A & B do not directly connect to points C & D, failure of the tandem will block connections between those points. There are 8 routes, assuming alternate routing, in network A. The routes are BE, BAE, AB, ABE, CE, CDE, DE and DCE. These routes all travel within the 6 segments so there are 6 segments, 68 conductor miles, 8 routes and 136 route miles.

Network B connects the same five points using a ring architecture that results in a flat network. The number of segments is reduced by 1 and the total conductor miles are reduced by about 10%. Both these considerations are important in view of the high costs of construction. The tandem switch costs are eliminated while quality is improved by elimination of the single failure point. These improvements do not come "for free," however, because the ring architecture employs almost twice as many route miles.

The cost of added route miles is rather small in the grand scheme, however. For example, the inputs to the FCC Synthesis Model reflect that the incremental costs per foot of an added strand are $0.0242 for aerial cable, $0.0287 for buried cable and $0.0229 for underground cable. A similar figure is implicit in the HAI model ($0.032 for fiber feeder, see HAI 5.2 inputs, fiber feeder, page 100).

In the simplified model above, assuming underground cable and using the FCC inputs, the CLEC would avoid the costs of at least 6 miles of fiber at $2.87/ft (total avoided cost of $90,900). However, the CLEC would need to deploy 4 added strands for an added cost of $9400 per strand (total of $37,600). Thus, the CLEC reduces its costs (compared to the layered architecture) by about $53,000 without taking into account the avoided investment for tandem switching or potential cost reductions from inserting ADM functions (that multiplex communications onto a single strand, rather than dedicating strands to particular node pairs).

Cost Drivers of CLEC Loops

Primary Cost Drivers of CLEC Switch-to-Customer Connectivity:

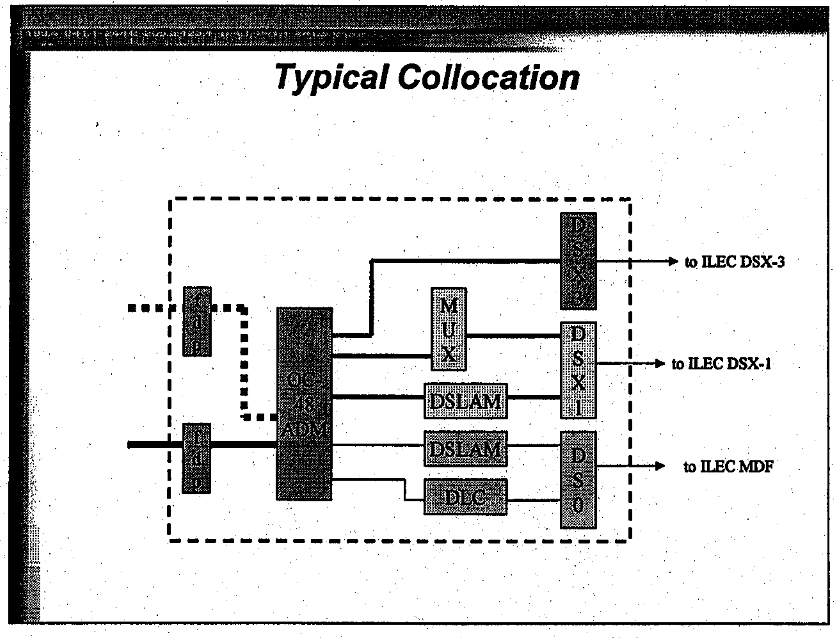
- Total demand
  - — objective to deliver greatest amount of customer premises traffic to CLEC switching point using shortest physical conductor in order to maximize "cost sharing" of relatively high fixed costs
- Infrastructure required at ends of segments
  - — transmission electronics (e.g., muxes, cross-connect devices, etc.) and associated space/HVAC have substantial fixed costs that generally do not scale with demand (e.g., an OC48 is not generally 4 times as costly as an OC12)
  - — fewer segments reduce infrastructure costs but also reduce demand that can share the costs
- Conductor placement costs (structures, materials, ROW, premises access, etc.)
  - — largely a fixed cost for capacity, but length of the facility is a large influence
- Practicality of hubbing
  - — essential to balance conductor and infrastructure costs necessary to attain better unit costs where a cost disadvantage (vis the ILEC) is a given
  - — success requires on-going access to relatively short and economic low capacity segments and cost-effective facility nodes

The preceding discussion should make it clear that a CLEC must carefully manage the infrastructure necessary to connect loops to its switched network. Because of the substantially fixed cost of the infrastructure, maximum utilization is essential to yield the lowest possible unit cost in order to be cost-competitive with the ILECs' efficient network..

The monthly cost of a facility-based node is in the range of $30,000 to $35,000 depending on the number of conductor miles employed and the number of facility-based sites (or nodes) on the ring. Virtually none of the costs are affected by the demand passing through the collocation until the total exceeds 48 DS-3s (and additional transmission equipment and possibly facilities are required).

Because of the fixed nature of the node costs, for low-demand locations, it is more economic to rely on alternatives that provide connectivity on a "pay-as-you-go" basis. For example, given typical 36 month tariff rates (zone 1 with pricing flexibility) for a Special Access DS3 (collo + 1 CT + 5 mi. IOT), a facility-based collocation would be a breakeven proposition when around 12 to 14 DS3s are involved, depending on the RBOC territory.

The key to justifying a facility build is identifying points where demand may be cost-effectively aggregated to the DS3 level. This is primarily accomplished by using UNEs and/or SA to hub non-facility based LSOs onto a hub collocation that is facility based. As the RBOC Fact Book data show, facility-based collocation currently occurs at a maximum of 13 out of 100 wire centers. Thus, the RBOCs' own data show that facility-based collocations do not exist in the large majority of offices. This limited penetration is *not* a result of a lack of CLEC desire to build facilities or because UNEs are available. Rather, it is a result of the fact that there is insufficient demand to justify the high cost of building such facilities.



In order to understand the requirements for a CLEC to provide facilities-based service, it is useful to first understand the nature of the necessary investment. There are three main categories of cost: (1) high capacity transport, (2) DS1 level demand aggregation; and (3) DS0 level demand aggregation. These aspects of cost are indicated in green, blue and orange, respectively.

Substantial fixed cost are incurred to establish the high capacity transport capability. Such costs primarily result from collocation charges, the physical ring facility and the add/drop multiplexing capabilities necessary to interface with the ring. In general terms, the monthly fixed costs run about $30,000 to $35,000 and split 20% collocation, 50% transport ring, 30% equipment/other. The split of the investment and the overall costs are, however, highly sensitive to the length of the fiber cable that must be deployed.

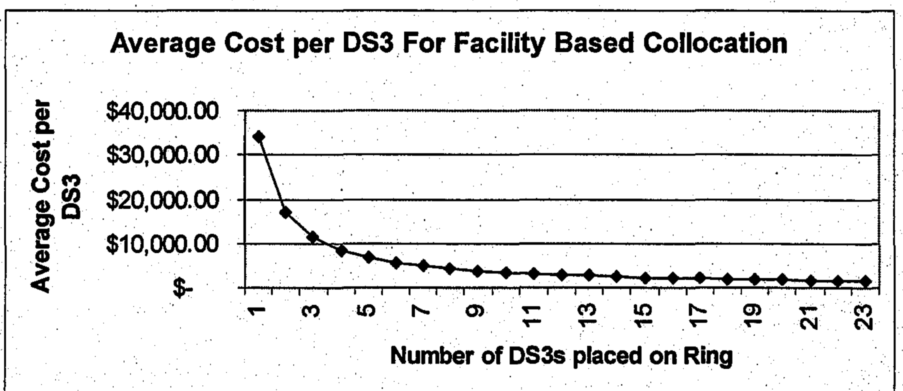
In the diagram above, the green shaded portion reflects the aspect of the CLEC build that is dedicated to the transport level. This includes the fiber ring facility, the fiber distribution panel (FDP) which terminates and connects both the interoffice facility, and the OC-48 ADM. The OC-48 ADM is the transmission equipment that adds and drops circuits on the ring facility. The ADM typically demultiplexes/multiplexes between the OC-3 level and the OC-48 facility and/or converts optical to electrical signals and demultiplexes/multiplexes between the OC-48 level facility and DS-3 level facilities. The remaining portion of the transport level equipment is the DSX-3, an essential a cross-connect device for two facilities at the DS3-level.

The DS1 level of the collocation is relatively simple. It includes the multiplexer (or MUX), which multiplexes/demultiplexes between the DS1 and DS3 level, or the DSLAM (digital subscriber line access modem) when it interfaces a transmission rate such as HDSL to the OC-3 level. The remaining DS1 functionality is the DSX-1, which provides much the same functionality of the DSX-3 at the DS1 level.

The DS0 level includes the DSLAM (when interfacing with 2-wire loops) and the Digital Loop Carrier, both of which deliver/receive multiplexed signals and interface an analog facility with an OC-3 channel. The DS0 right-most box is simply the cross-connection device for copper pair facilities.

It is important to note that although all levels of equipment are shown, not all collocations are fully equipped.

Capacity Cost at a "Typical" Facility-Based Collocation

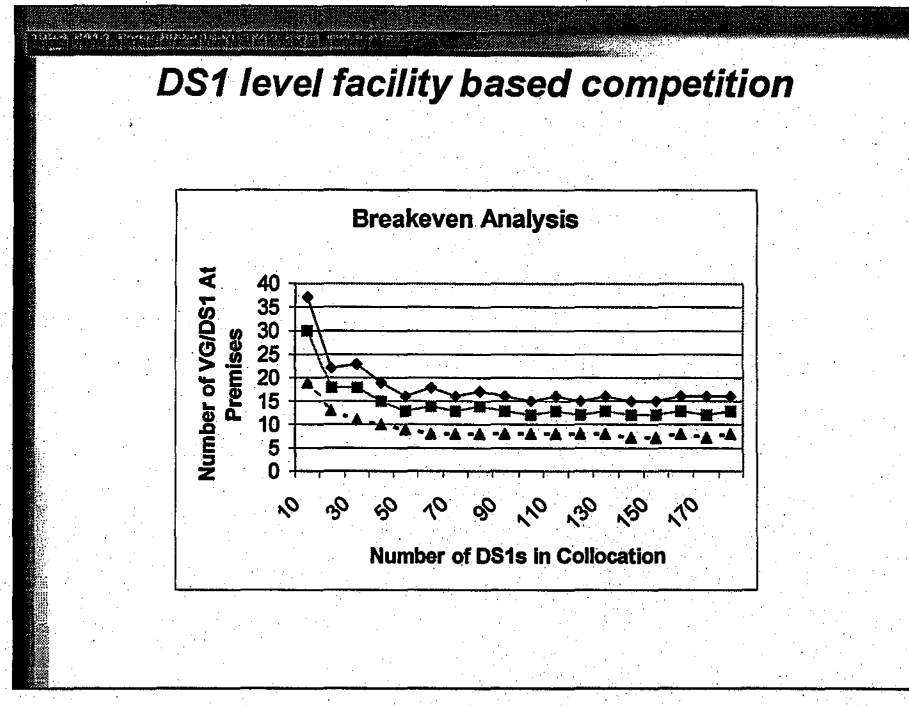


In light of the largely fixed costs of the facility-based node, scale is important. In fact, until about 10 to 12 DS3s of demand are reached, the rate of change of the average cost per DS3 is quite significant. In the case of this specific example, by about 10 DS3s of total demand, the average monthly cost is $3,400 per DS3; at 18 DS3s it is reduced to about $1900 and by 24 DS3s the cost is in the range of $1400-$1500 per DS3.

If sufficient demand is gathered to efficiently utilize at least 12 or more DS3s, it begins to become feasible for a competitor to replace transport alternatives such as ILEC Special Access. The cost of a DS3 obtained as special access are in the range from $1800 to $2400.

Unfortunately, very few customer locations generate sufficient demand to individually justify a DS3 connection. As a result, the demand from multiple customers, possibly from across multiple offices, must be combined at a common point to justify a collocation. The issue for CLECs, however, is that all this investment for connectivity and demand aggregation is required simply to extend the ILEC loop plant to the CLEC's network and, as a result, represents a cost the incumbents do not incur, because the ILEC loop plant terminates at the ILEC switch location.

Nevertheless, customers employing sufficient demand to justify a DS1 loop, rather than multiple voice grade loops, represent an opportunity for facility-based CLECs. However, the opportunity exists as a result of the savings from replacing many voice grade UNE-Loops with a single DS1, not because of any advantage or cost avoidance in the CLEC's backhaul network. In fact, in many instances, unless the customer has a rather large number of voice grade loops, the loop replacement savings will not be sufficient to offset the cost of premises equipment (channel bank) and node equipment (e.g., DS3:1 muxes) and backhaul.



This chart illustrates the implications of serving a customer location from a facility-based node. The chart shows the number of voice grade loops that must be replaced in a conversion to DS1 level access in order for a facility-based service to break even. Note that the maximum number of two wire loops that can be replaced by a single DS1 loop is 24, but practically the breakeven point is somewhat less.

If one assumes that the backhaul facility investment is available at no cost because it was justified for other purposes (and assuming the capacity would not otherwise be used), the break-even occurs in the range of 7 –11 VG loops per DS1 loop (see lowest/dotted line). Note that this breakeven level is based upon the assumption there are at least 30 different customer DS1s being served from the node. This number of loops in the collocation and number of loops replaced is required solely to offset the costs of added customer premises equipment (channel banks), collocation multiplexing (from DS1 to OC48) and interface equipment at the switch necessary to interoperate with the channel bank

If the DS1 level demand is necessary to justify the build in the first place, (that is, the demand from the largest customer locations and that from non-voice/non-local services is not sufficient) then the breakeven levels are much higher, probably more in the range of 16 to 19 loops replaced per DS1, and at least 40 customer DS1s would need to be served from the collocation. This higher figure results from the fact that the transport/backhaul facility cannot be treated simply as otherwise unused capacity. The diagram illustrates the cross-over at the approximate minimum demand for a collocation (12-13 DS3, see upper-most line) and the cross-over for a large facility-based collocation (>18 DS3s, see middle/purple line)

The two different situations illustrate that, except for the largest customer locations, the demand aggregation and backhaul costs implicit in CLEC networks are difficult to offset, even when the customers' loops home on an LSO where a CLEC has a facility-based collocation.

Even worse economics exist for remote LSOs and for customers served via EELs. As a result, any factors -- regulatory, operational or otherwise -- that increase the costs of these configurations makes it that much less likely that such customers will be served at all, much less served through a facility-based collocation.

CLEC's "Loop" Plant Realities

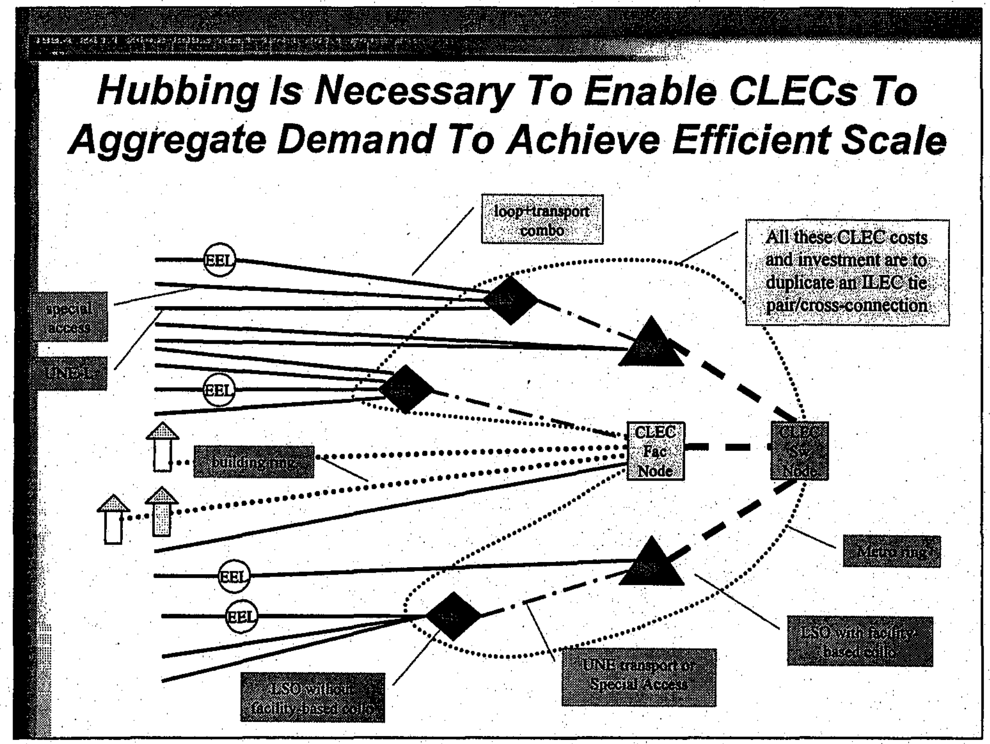
- At every point of demand aggregation the majority of the costs are fixed for a relatively large demand set
- CLEC costs are always over-and-above the incumbent costs, so building volume only reduces the CLECs' cost disadvantage
- Few LSOs have the demand potential for an individual CLEC that warrants a facility build
- The huge fixed costs of facility-based collocations require a means to aggregate demand that does not require building at every LSO
- No single office will likely support facility-based collocation to serve only voice grade loops

CLEC loop costs for equivalent customer loop configurations will always have higher unit cost than the ILECs' because, except for the rare instances of direct builds*, the CLEC must use the ILEC loop and then add collocation/backhaul costs. Because these added costs are typically *fixed,* the CLEC will generally deploy its loop plant so that it has only a few strategically placed facility-based collocations. Although some customers loops will directly terminate on these collocations, most will not. Other collocations must home on these hub (facility-based) collocations using high capacity transport, generally obtained from the ILEC. By using this architecture, a CLEC can reach customers that terminate on these "remote" LSOs where it is cost prohibitive to build but which may offer some opportunities for cost sharing from demand aggregation. The critical consideration is that the additional cost of transport to reach the remote LSOs is not, when added to the equipment cost of DS0 and/or DS1 demand aggregation, so high as to preclude competitive pricing of services. In instances where it is not cost prohibitive, a loop+transport configuration can be used to extend the loop facility to the CLEC's facility-based collocation of the CLEC.

It must also be noted that DS0 level services have the greatest aggregation overheads. These services are also burdened with the highest costs and most cumbersome process for conversion from the ILEC's network to the CLEC's network. As a result, DS0 level service is unlikely to prove in a collocation on its own merits. Accordingly, unless there is a means to expand CLEC networks using a combination of self-provided and ILEC provided facilities, it is unlikely that facilities based competition will survive, much less thrive, except for the relatively few customer locations requiring loops with capacities exceeding more than a few a DS3s.

Notes

* Direct builds are only practical (in theory) for about 50 to 60 thousand customer locations nationwide. In fact, only a small portion of these locations can be efficiently served by competitive facilities because of issues such as (1) ILEC existing facilities that are able to serve existing demand or easily upgradeable to do so; (2) construction costs and delays, created by ROW, building access and similar problems; and, (3) limitations on building access.



This diagram depicts how a CLECs aggregates and homes customers onto its network. All the above are expenses and investments incurred simply to permit the CLEC to use its own switch to serve it customers. Each LSO and node passed as one moves from the customer location on the left to the CLEC network on the right is a point where the CLEC must incur substantial fixed costs. Cumulatively, the costs between the first LSO and the CLEC switch are costs the CLEC must incur to obtain functionality equivalent to a tie pair in the ILEC central office that connects the loop side of the main frame to the other side of the main frame, where connections to the local switch port exist.

There is general agreement that CLECs cannot practically replicate the ILECs' local loops, especially the copper loop plant used to provide most voice services. In most cases, it is equally impractical to build new facilities to connect most LSOs to a CLEC network – connections that are the functional equivalent of CLEC feeder plant and for which the ILEC incurs absolutely no additional cost when providing service using its own network. Thus, when a CLEC uses an ILEC loop to provide service, the CLEC pays for the entire cost of connecting its customers to the ILEC's LSO. However, to provide service to the customer with its own switch, the CLEC – but not the ILEC – must incur substantial costs to extend the loop facility to a different location.

Facility-Based DS0 Competition is Constrained

Number of Total Lines Per Wire Center By Number of CLECs Serving RBOC Wire Center					
RBOC Area	0	1	2	3	4
Verizon	4,431	8,259	16,519	20,649	51,150
SBC	4,074	9,586	16,422	19,261	37,419
BellSouth	3,091	8,348	12,400	25,318	34,541
Qwest	3,571	9,895	13,656	22,460	38,983
Overall	3,965	8,958	15,334	21,353	40,542
% of Offices	52%	13%	7%	3%	24%
% of Lines	14%	8%	7%	5%	66%

Share of office business demand required per CLEC per DS3* By Number of CLECs Serving RBOC Wire Center					
RBOC Area	0	1	2	3	4
Verizon	143%	49%	30%	24%	10%
SBC	111%	66%	29%	25%	13%
BellSouth	235%	130%	39%	19%	21%
Qwest	152%	64%	31%	19%	16%
Cross-RBOCs	114%	71%	35%	25%	13%

* assumes 90% DS3 fill, 4:1 DLC concentration and only business lines addressed

Derived from UNE Fact Report 2002, Tables 4 & 5, p. II-6 and WC counts derived from ARMIS 43-08 and LERG data

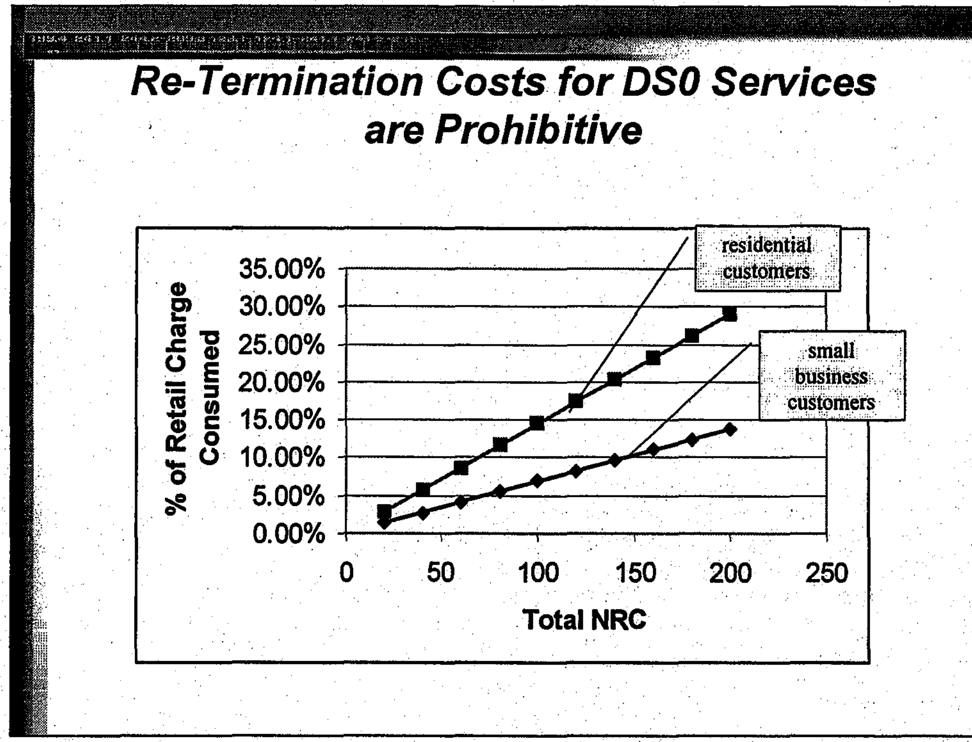
The difficulty of cost-justifying facility-based DS0 services for small customer locations is exacerbated by the difficulty in generating any meaningful scale. Without scale, the fixed cost overheads of the backhaul penalty become prohibitive.

The data in the RBOCs' "Fact Book 2002" are useful to illustrate this point. Tables 4 & 5 on page II-6 permit the sizes of various strata of wire centers to be deduced by the number of CLECs asserted to be operating in those wire centers. The same tables permit the number of business lines to be determined for those strata. The data show, on average and under current conditions, that a CLEC cannot individually accumulate sufficient share to support facilities construction in two thirds of RBOC Wire Centers. Even for those largest offices, a single CLEC offering facility-based DS0 service would need to win a minimum of 10% of the business lines, and in most from one quarter to one third of the business lines.

What this makes evident is that under the current conditions only the largest offices can support DS0 level facility-based competition -- and even then only one if one of the four plus competitors pursued the strategy and was extremely successful.

If the Commission is to promote facility-based investment for the DS0 markets, then, it must take every step possible to encourage CLECs to build facilities – including continued availability of high capacity transport UNEs without limitations as to use. But, as the next slide shows, the step is necessary but not sufficient.

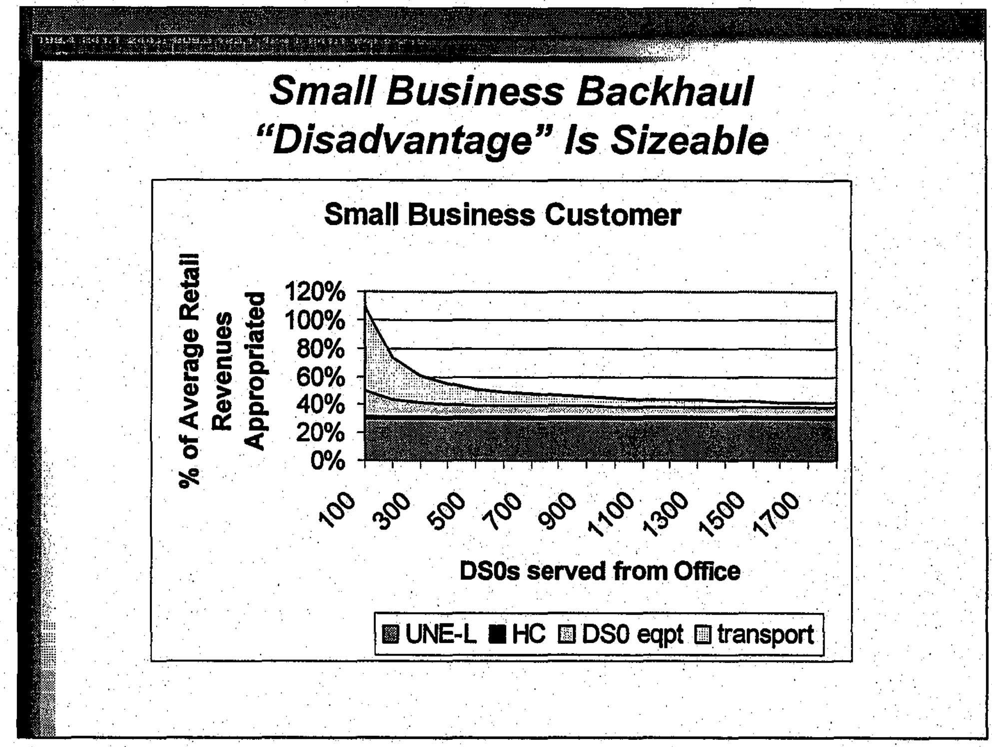
Note: The derivation of the figures displayed in the table are rather simple. The referenced Tables provide the percentages of wire center, residential lines and business lines based upon whether the WC has >=1, >=2, >=3 or >=4 facility based competitors. Subtracting the results of neighboring cells allow one to determine the number and % of wire centers, residential, business and total lines that have 0, 1, 2, 3, and 4 facilities based competitors. With the total lines and wire centers available from ARMIS and LERG reports, the absolute figures can be established from the percentages and the average switched access line VGEs per wire center established by cell. Because the residential and business lines are known, the % of business lines can be applied to the average wire center size for a particular cell. After that, the minimum share computation is simple. A DLC equipped to handle 2016 lines will require a DS3 transport (this assumes 4:1 concentration for the lines). At 90% utilization, the DS3 will carry about 1800 lines (2016*90%). The 1800 line figure divided by the business "lines" per wire center in each cell (generally in the range of 30% to 40%) yields the minimum share the CLEC must capture.



On top of the relatively small addressable market, CLECs must contend with the sometimes enormous one-time costs to move a customer from the ILEC network to the CLEC network. Although charges for the re-termination (or hot cut) process vary, the financial impact is almost always significant.

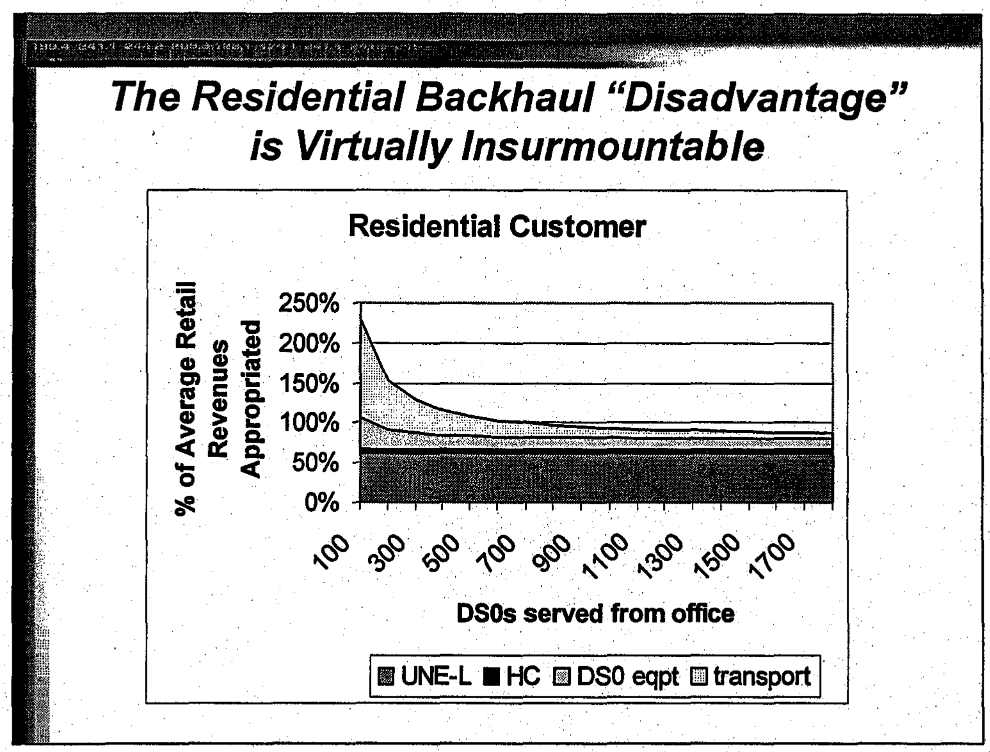
When expressed in terms of the average local revenue for small business and residential customer, the competitive disincentive due to hot cut charges is clear. [Residential and business average retail rates were taken from Tables 14.1 and 14.2 of the 8/01 FCC Telephone Trends. Non recurring charges were amortized over a 36 month period. The residential figures were $20.78 monthly and $44.10 NRC. The business was an average of $43.90 flat rate and $44.45 measured rate and a $72.29 NRC. All figures are from 2000]. As the chart shows, a $100 re-termination cost consumes almost 7% of the business retail revenues over the life of the account. For Residential customers, the figure is closer to 15%.

Results in individual states will obviously vary, but it is clear that the RBOCs have engaged in a concerted effort to raise hot cut non-recurring charges at the same time they are urging the Commission to sharply restrict the availability of unbundled local switching, particularly as part of the UNE-P combination



Notably, the financial issues for DS0 level service do not end with hot cut charges for the CLEC because other substantial and largely fixed costs must be incurred in order to access customer loops. In particular, the cost of backhaul is a major deterrent to facility-based DS0 service. Said another way, unless a CLEC has other reasons to deliver service through a facility-based collocation – such as to private line services and or access services to high volume customer locations – it is difficult to justify the backhaul cost and other DS0 infrastructure to support DS0 facility based service for small customer locations.

On the other hand, in locations where a facility-based collocation does exist (and capacity may otherwise be unused on the ring), the major economic deterrent to facility-based competition is the ILEC charges for the loop and for the hot cut. Note that the loop and hot costs alone consume a sizeable portion of the revenues -- about 30-35% of average retail revenues, assuming use of the median recurring charge for the loop ($13.83) and median hot cut charge of $35.



Because of the much lower revenues from residential consumers, there is little likelihood that economic facility-based competition can develop for basic local service in the current environment. If the customer loop terminates to an ILEC wire center where the CLEC does not have a facility based collocation, the costs of the loop connectivity alone (assuming the median hot cut charge of $35) would consume *over 100%* of the average revenues. For the average residential customer subject to the median hot cut charge, that charge alone appropriates 11% of the average local revenues.

Unfortunately, the prospects are not much better even where the residential customers happen to be located in an LSO where the CLEC has facility-based collocation. In those instances, the loop connectivity accounts for at least 80% of retail revenues, regardless of the volume of customers the CLEC serves from the office. Thus, if residential facility based competition is to evolve, a more robust revenue stream is required than is implicit in the "average" residential local service customer.

Summary

- The ILECs rationally and economically deployed loop plant within their operating areas that is extremely flexible an possesses scale economies only available to it as a monopolist
- CLECs seeking to deliver service using their own facility-based network must use the ILEC loop plant, but must also invest heavily to extend ILEC loops from ILEC LSOs to their own networks
  - — The investment replicates the functionality of a single cross-connect in the ILEC LSO
  - — The investment, although absolutely essential, provides no service functionality
  - — Backhaul penalties at the DS0 level are easily in the range of $4.00/month /DS0 where thousands of DS0s are served in a single office and are even more cost prohibitive where only a few hundred DS0s are served

Summary

The high fixed cost of CLEC "network" investments means that facility-based collocations can only be justified where there are high concentrations of demand

- Only the top 15-25% of RBOC LSOs appear attractive on a standalone basis
- Hubbing, to the extent practical and cost-effective, can be employed to fill unused capacity at facility-based collocations and, if transport is available at TELRIC, it can be a precursor to adding a new node
- DS0 demand alone cannot justify a facility-based collocation -- such demand only enhances the attractiveness of an investment justified by other services
  - One DLC = ~2000 DS0 = 1 DS3 (at 4:1 GR303 concentration)
  - In the largest ILEC offices, 2000 DS0 = 10% to 20% share of the business switched access lines for a single CLEC
  - At least 10 DS3s are required to bring typical facility-based collocation costs to a manageable level of added burden
  - The hot cut "tax" exacerbates the situation for DS0 services
    - Median charge imposes a $3/month burden over the average account life
    - High end hot cut charges can approach a burden of $18/month
    - May make DS0 service unattractive even in a facility-based LSO

Summary

The high fixed cost of CLEC "network" investments means that facility-based collocations can only be justified where there are high concentrations of demand

- DS1-based services likewise will not generally be addressed outside of a facility-based collocation, because the cost saving from voice grade loop replacement are generally insufficient to offset added backhaul costs
  - Channel bank deployment costs, combined with added backhaul costs, require about 40 DS1s in remote LSOs with each DS1 replacing an average of 16 to 19 VG loops at the customers' premises. This translates to a 15% to 17% share of switched business line VGE in a modestly sized RBOC wire center (10-15K "line" average)
  - Even at a facility-based collocation (and assuming "free" backhaul), a minimum of 30 DS1 loops with each replacing about 10 to 11 VG loops at the customers' premises is required to break even. This translates about a 5% business switched VGE share in the largest RBOC wire centers (>20K "lines" per wire center)

Summary

- Hubbing can only be supported if demand can be homed to central sites in a cost-efficient manner
  - Hubbing will always result in higher costs for the CLEC loop plant unless hubbed demand fills unused capacity in transport that was justified for other non-switched/ non-local purposes
  - Current use restrictions, lack of generally available transport UNEs and prohibitions on co-mingling all serve to make hubbing a risky (and generally marginally cost-effective) undertaking for switched local service
  - Absent the opportunity to hub using cost-effective and non-discriminatory alternative backhaul facilities, CLEC facility investment will remain largely at current levels

Summary

- Regulatory uncertainty only makes a difficult situation worse for CLECs
  - Potential de-listing of transport UNEs jeopardizes hubbing
  - Use restrictions limit locations that can serve as attractive nodes or hubs
  - Commingling restrictions produce the same result
  - Potential de-listing of high capacity loops jeopardizes the attractiveness of DS1 and above level customers
  - Limiting access to narrowband services further curtails CLECs' opportunity to build scale and share fixed costs
  - De-listing of switching (and the practical elimination of UNE-P) without addressing the hot cut tax would places virtually all DS0 services off-limits to the CLECs
- All the ILEC attacks on UNEs (and combinations) are premised on the absurd notion that CLECs are NOT impaired in their efforts to cost-effectively deploy the functional equivalent of a ILEC cross-connection